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Results of an Aerial Population Survey of Reintroduced Bison (*Bison bison*) in Southwestern Yukon

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Abstract

- Population censuses for the Aishihik bison population are used to track their restoration, as well as to support an annual harvest that is well-subscribed by Yukoners.
- The last population census was conducted in July 2016 and estimated 1258 adults (90% confidence intervals = 1120–1434). A census was scheduled for July 2019. However, for the second year in a row we were unable to conduct the survey due to circumstances beyond our control.
- In lieu of a population census, we sought to obtain a minimum count by counting as many bison as possible during the time allotted (one day). We focused our search effort on known locations of 29 GPS-collared bison, as well as other areas that were known to be seasonally used.
- We flew approximately 1046 km (excluding ferry from Whitehorse), during which we observed 55 groups of bison, totaling 1054 adults and 271 calves. Calf production (26%) and the ratio of dominant bulls to adult females and yearlings (14%) appeared good.
- For management purposes, the Minimum Number Known Alive (MNKA) is 1054.
- Overall, the population looks healthy in a demographic sense, and is above the 1000 animals suggested in the 2012 Yukon management plan and the 2018 national recovery strategy.
- The true population size, however, remains unknown and there is a need to get an accurate population estimate to inform a plan review and harvest management. The next opportunity to do so will be in July 2021.
- Exclusive of staff time, project costs were approximately $18,500.

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Introduction

Bison (*Bison bison*) were reintroduced into the Aishihik area from 1988 to 1992 as part of a national recovery effort to restore the species to its native range (Government of Yukon 2012). Since then, the population has grown substantially and was last estimated in July 2016 at 1258 adults (90% confidence intervals = 1120–1434). Population censuses are a fundamental monitoring initiative for the Aishihik population, and are used to track the restoration effort as well as to support an annual harvest that is popular with many Yukoners. Since 2007, bison management in Yukon has relied on mark-resight methodology, using paintballs to mark animals, to estimate the size of the population (Hegel et al. 2012, Jung and Egli 2011, 2014). Bison harvest in Yukon is managed under an adaptive management framework, and repeated population estimates allow bison managers (i.e., the Aishihik Bison Technical Team) to track population trends and evaluate the effectiveness of changes in the harvest regime.

Mark-resight population estimates for the Aishihik population were conducted using consistent methodology in 2007, 2009, 2011, 2014, and 2016. A detailed account of the methodology used to conduct a mark-resight population estimate of bison can be found elsewhere (see: Hegel et al. 2012, Jung and Egli 2012, 2014). An updated population estimate was scheduled for July 2019, in part to support a review of the 2012 bison management plan. Unfortunately, 2019 was a year of extensive forest fires across the territory and contracting a helicopter to do the work was not possible, so the census was postponed until 2020. Substantial effort was made in 2020 to obtain another mark-resight population estimate. However, again, it was not possible to conduct the census because a third of the 29 GPS-collared bison did not move into the alpine, particularly in the Hutshi area, as they typically do in mid-June to late-July. Reasons for this change in behaviour are unknown, but it may be due to the cool, rainy weather that occurred during June and July. Our mark-resight methodology is predicated on bison being congregated in open alpine habitats (Figure 1) where the number of marked (paintballed) animals could be precisely counted (Jung and Egli 2012, 2014). With many bison not migrating to the alpine and

Fig. 1. Bison in the alpine near Ittlemit Lake on 17 July 2020.

remaining in treed habitats at low elevations it would have been exceedingly challenging to accurately count them, especially the marked individuals. As such, because of the behaviour of the bison, a mark-resight survey under the July 2020 conditions was unlikely to produce a reliable population estimate, and the work was again postponed.

Given that a renewed planning effort was underway and coupled with two years of record high harvest numbers, it was decided that an updated sense of the current number of bison in the population was required. In fall 2019, a simple deterministic population model was developed in lieu of a current census in the field. The model was based on available demographic and harvest data. That model performed well when compared to previous population estimates from 2011 and 2016, and predicted that in April 2019 the population was comprised of about 1370 adults (we do not include calves in these estimates).

Because a mark-resight population estimate was not possible in 2020, it was decided to truncate the field effort and instead aim to get a minimum count of the herd (also known as the Minimum Number Known Alive [MNKA]); in part to see if the modeled population estimate seemed plausible. Briefly, a minimum count is just that; we count all the animals we can find and get a minimum number of animals available in the population. By contrast a population estimate, as was performed in July 2016, uses statistical modeling to estimate the true population size—which is the number seen during the survey plus an estimate of those missed. To do a population estimate, however, you need to mark a number of animals before counting them and meet a number of statistical assumptions of reliably seeing marked animals in the field. This was not tenable this summer because many bison were in the trees and it would be likely that marked animals would not be distinguishable. Additional objectives of the 2020 aerial survey were to obtain data on the spatial distribution of the population, percent of calves (reproductive rate), and age-sex composition.

Methods

On 17 July 2020, we used an AStar B2 helicopter to locate and count bison to obtain a Minimum Number Known Alive (MNKA). The crew consisted of a navigator, two observers, and the pilot. Our strategy was to find bison associated with 29 GPS-collared animals, based on their locations from the previous day (Figure 2), as well as by searching other areas known to be seasonally used by bison during the summer. In a few instances we used radio-telemetry to locate GPS-collared bison if they were not found at their last known location; however, we did not rely on telemetry for the majority of the survey because it was too time consuming. To be clear, we sought to obtain the best MNKA by aiming to count as many bison as possible during the time allotted (one day), while distributing our effort across their known range.

When we encountered a group of bison the navigator counted and determined group composition of all adult (≥1 year old) animals, while the observer seated behind him counted the calves. The coordinates of each group encountered were obtained with a GPS. Additionally, we marked a few bison from each of three different groups with paintballs (Figure 3) because there were many bison groups in those areas and we wanted to ensure that groups were not counted twice. From the field data, we determined the MNKA, using adults only. We also calculated the percent of calves and dominant bulls in the population, as well as the mean (average) group size.

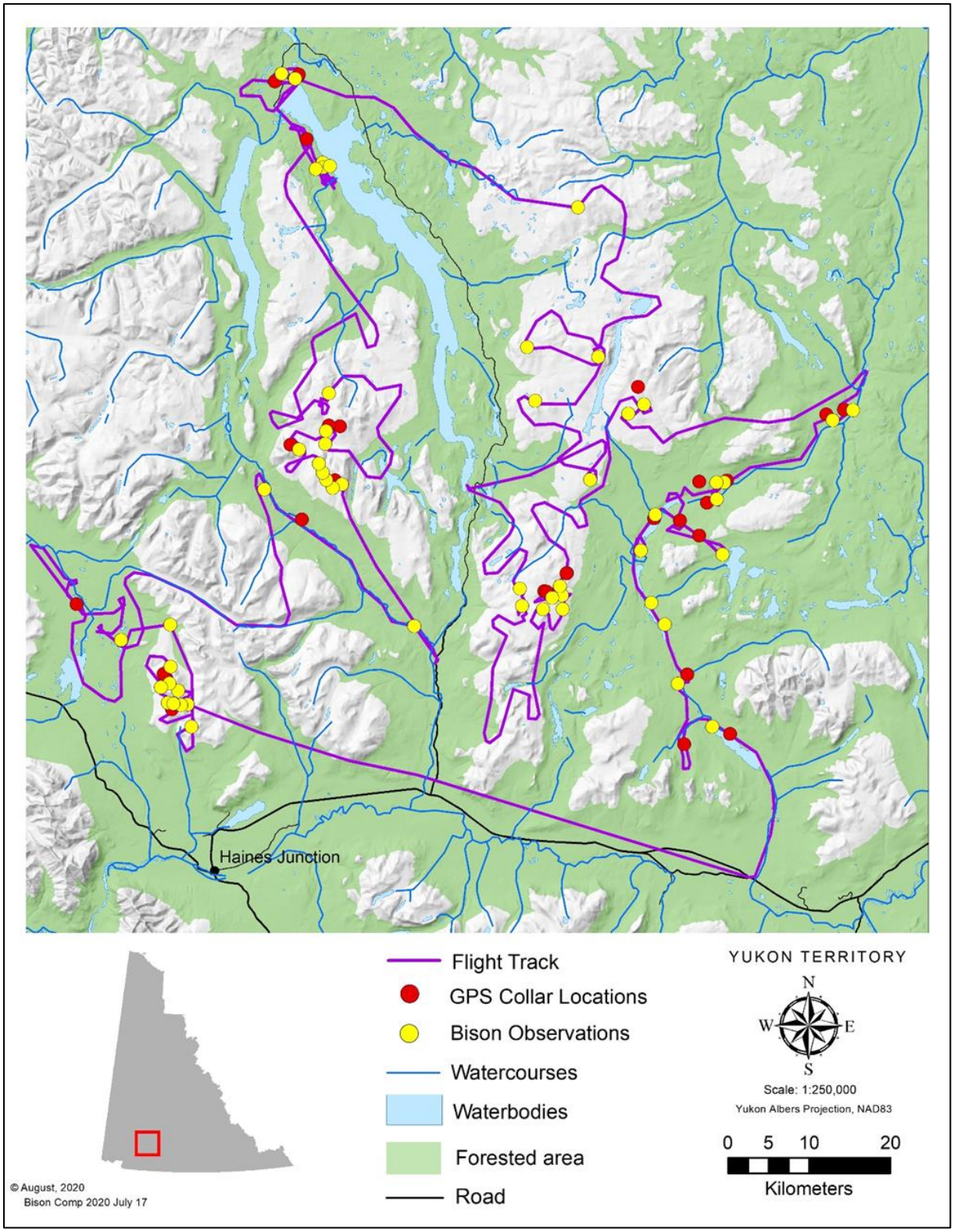

Fig. 2. Flight track and bison observations during the census conducted on 17 July 2020.

Fig. 3. Example of bison being marked with paintballs during an aerial survey.

Results and Discussion

We flew approximately 1046 km during the survey (excluding ferry from Whitehorse), and used 8.2 hours of helicopter time (including ferry from Whitehorse). Survey conditions were perfect, with little to no cloud cover, although winds were at times strong. We were not prohibited from flying anywhere due to weather.

We observed 55 groups of bison, totaling 1054 adults and 271 calves (Table 1). Thus, for management purposes, the total MNKA is 1054. This is the largest number of Aishihik bison counted in a single day. The MNKA from the 2014 and 2016 mark-resight estimates were 857 and 853, respectively, but less hours were flown per day than in 2020.

Group size ranged from 1 to 108 bison (including calves), with particularly large aggregations occurring in the Kloo Lake area and north of Big Mountain. Mean group size for mixed groups was 36.9 ± 28.8 SD (n = 35; range = 2–108), and that for bull only groups was 1.8 ± 1.1 SD (n = 20; range = 1–4). Group size is greatest at this time of year because mixed groups coalesce and dominant bulls join them in large post-calving aggregations, prior to commencement of the rut (Figure 1). Regardless, the average size of mixed groups was greater than typically seen, which during July in 1999–2014 was 21.7 bison per group.

Calf composition, a measure of productivity, was 26 calves per 100 adults. This value was the same as that obtained during the last two mark-resight surveys in 2014 and 2016, which both were also 26 calves per 100 adults. It is remarkable that calf production has been so consistent across these past six years. However, to be clear, this measure of productivity does not translate directly to the number of calves that will be recruited into the population at the end of next winter, as an unknown number will die before then. Moreover, the number that do recruit into the population is likely variable from year to year, in response to factors such as predation, snow depth, or winter severity.

The percentage of mature, dominant bulls (≥8 years old) to adult females seemed reasonable at 14%. This percent is an underestimate of dominant bulls to females because it was not possible to sex the yearlings so both sexes are included. Moreover, another 24% of the animals observed were younger bulls (estimated at 2–7 years old), and many of these

will likely survive to become dominant bulls in the near term. While the minimum percent of dominant bulls required to maintain a bison population is unknown, it is likely a low percent because only a few dominant bulls are successful in breeding.

Bison were distributed widely across their known range, with many observed in the alpine around Kloo Lake, Ittlemit Lake, and Long Lake, as well as at low elevations near Husthi and Taye lakes, and Aishihik Village (Figure 2). The number of animals observed near Aishihik Village was unusual for this time of year, as was the failure of those in the Hutshi Lakes area to move into the alpine south of Long Lake, toward Big Mountain. Reasons for these anomalies in the distributions when compared to distributions from previous years are unknown. The implication, however, is that a large percent of the population was in the trees at low elevations and were challenging to find and count, confirming that mark-resight methods would not have led to a reliable population estimate this summer.

Incidental observations of other wildlife were also made. Where feasible we counted the number of individuals and recorded their locations. We saw grizzly bears (*Ursus arctos*) on two occasions. Both times bears were adjacent to groups of bison with calves and it is quite likely that they are occasionally predating calves. Five groups of caribou (*Rangifer tarandus*), totaling 204 animals, were seen, most of which were associated with snow patches at high elevations. Two moose (*Alces americanus*) were observed on separate occasions, and 2 mule deer (*Odocoileus hemionus*). Finally, we saw numerous thinhorn sheep (*Ovis dalli*) but did not consistently record their location or group size because we kept our distance and avoided them. Similarly we observed several golden eagles (*Aquila chrysaetos*) and bald eagles (*Haliaeetus leucocephalus*) but did not record their locations.

Exclusive of staff time, project costs were approximately $18,500.

Table 1. Raw count data from an aerial survey of bison on 17-July 2020.

Waypoint	No. Calves	No. Females & Yearling Males	No. Young Males	No. Dominant Males	Total Adults & Yearlings	Group Type	Group Size
157	0	1	8	1	10	Mixed	10
158	23	33	34	6	73	Mixed	96
159	7	20	8	3	31	Mixed	38
160	29	74	1	4	79	Mixed	108
161	0	0	0	1	1	Bull only	1
162	0	0	0	1	1	Bull only	1
163	3	4	4	0	8	Mixed	11
164	7	10	6	2	18	Mixed	25
165	18	44	9	2	55	Mixed	73
166	0	0	0	1	1	Bull only	1
167	0	0	0	1	1	Bull only	1
168	8	23	4	2	29	Mixed	37
169	4	5	1	2	8	Mixed	12
172	2	6	1	1	8	Mixed	10
173	0	0	0	1	1	Mixed	1
174	5	13	8	1	22	Mixed	27
175	0	0	2	1	3	Mixed	3
176	8	27	11	2	40	Mixed	48
177	6	19	2	0	21	Mixed	27
178	0	0	0	2	2	Mixed	2
179	22	32	13	4	49	Mixed	71
180	0	0	0	2	2	Mixed	2
181	7	22	11	1	34	Mixed	41
183	7	15	3	2	20	Mixed	27
184	1	1	0	0	1	Bull only	2
185	2	12	2	1	15	Mixed	17
186	0	0	0	1	1	Bull only	1

Waypoint	No. Calves	No. Females & Yearling Males	No. Young Males	No. Dominant Males	Total Adults & Yearlings	Group Type	Group Size
187	9	46	19	12	77	Mixed	86
188	3	6	13	2	21	Mixed	24
190	0	0	0	1	1	Bull only	1
192	0	0	0	1	1	Bull only	1
193	0	0	0	2	2	Mixed	2
194	0	0	4	0	4	Mixed	4
195	2	4	1	0	5	Mixed	7
196	0	0	0	4	4	Bull only	4
197	6	42	26	6	74	Bull only	80
200	0	0	0	2	2	Mixed	2
201	0	0	0	1	1	Bull only	1
202	4	10	1	0	11	Mixed	15
203	0	0	0	1	1	Bull only	1
204	14	49	19	5	73	Mixed	87
206	12	26	10	2	38	Mixed	50
207	6	11	1	2	14	Mixed	20
208	0	0	0	4	4	Bull only	4
209	17	30	7	3	40	Mixed	57
210	0	0	0	1	1	Bull only	1
211	0	0	0	1	1	Bull only	1
212	9	20	8	1	29	Mixed	38
213	5	9	4	0	13	Mixed	18
214	1	3	0	0	3	Mixed	4
215	0	3	1	0	4	Mixed	4
216	3	34	0	0	34	Mixed	37
217	4	25	0	0	25	Mixed	29
218	13	18	7	2	27	Mixed	40
219	4	9	0	1	10	Mixed	14
Totals	**271**	**706**	**249**	**99**	**1054**		**1325**

Conclusions

Our aerial survey indicates that the current size of the Aishihik bison population is a minimum of 1054 animals, not including calves. Moreover, calf production appears consistent with previous estimates and the ratio of dominant bulls to adult females and yearlings also seems good. Overall, the population looks healthy in a demographic sense, and is above the 1000 animals suggested in the 2012 territorial management plan (Government of Yukon 2012) and the 2018 national recovery strategy (Environment and Climate Change Canada 2019).

That said, the fundamental problem with a minimum count—such as this work—is that it provides no indication of the true population size, unlike a mark-resight census or similar type surveys. This is because we have absolutely no reliable estimate of the number of animals missed in the survey. For example, we may have missed 100 or 500 animals and there is no way to know which may be the case. Even though we obtained the largest MNKA to date, it does not mean the herd has grown (or declined) since our last count—it simply means that we had a 'good day' in counting them. Indeed, we attribute much of our success in obtaining a high MNKA count to the GPS collars which aided us in identifying group locations. Without knowing the locations of the collared animals our MNKA would almost certainly have been substantially lower; thus, pointing to the value of having a reasonable number of bison radio-collared.

There remains a need to get a reliable population estimate (bounded by confidence intervals) of the Aishihik herd to aid in a plan review, and inform current harvest management. Given the limitations of the MNKA approach, it is recommended we conduct a statistically robust population estimate, using a mark-resight or other approach in July 2021.

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